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(54) Abstract Title
 Call back facility

(57) The apparatus comprises means for receiving a callback request signal on the basis of a non-circuit-related data transfer mechanism, such as a short message signal (SMS) message or an Unstructured Supplementary Service Data (USSD) message, transmitted from a mobile station. In response to the received callback request signal the apparatus establishes a first circuit connection to the mobile station, and a second circuit connection to a third party on the basis of information contained in the received callback request signal. The apparatus then bridges the first and second circuit connections.

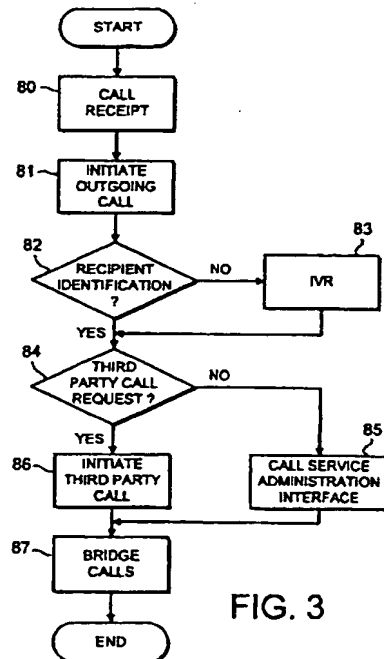


FIG. 3

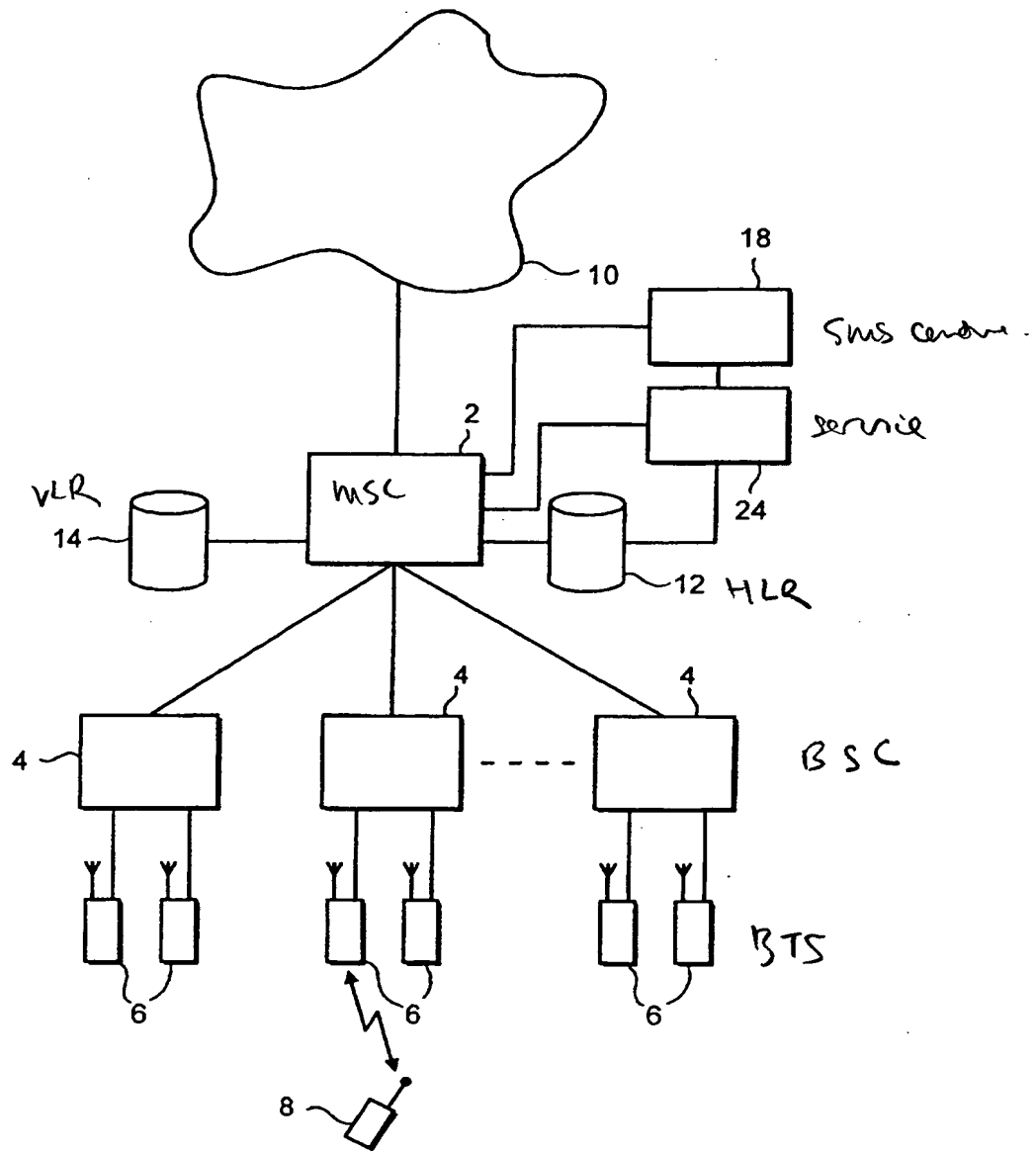


FIG. 1

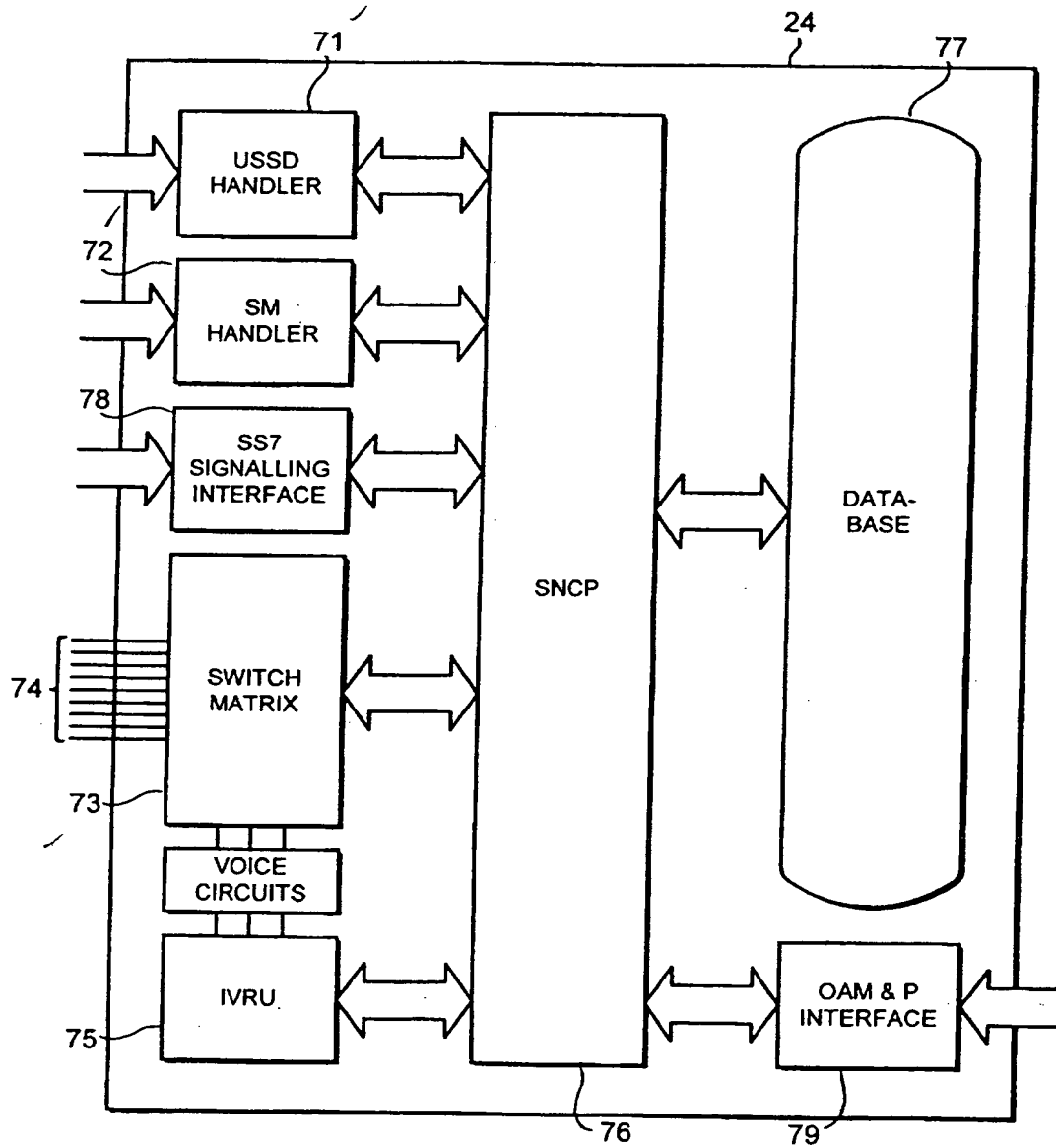


FIG. 2

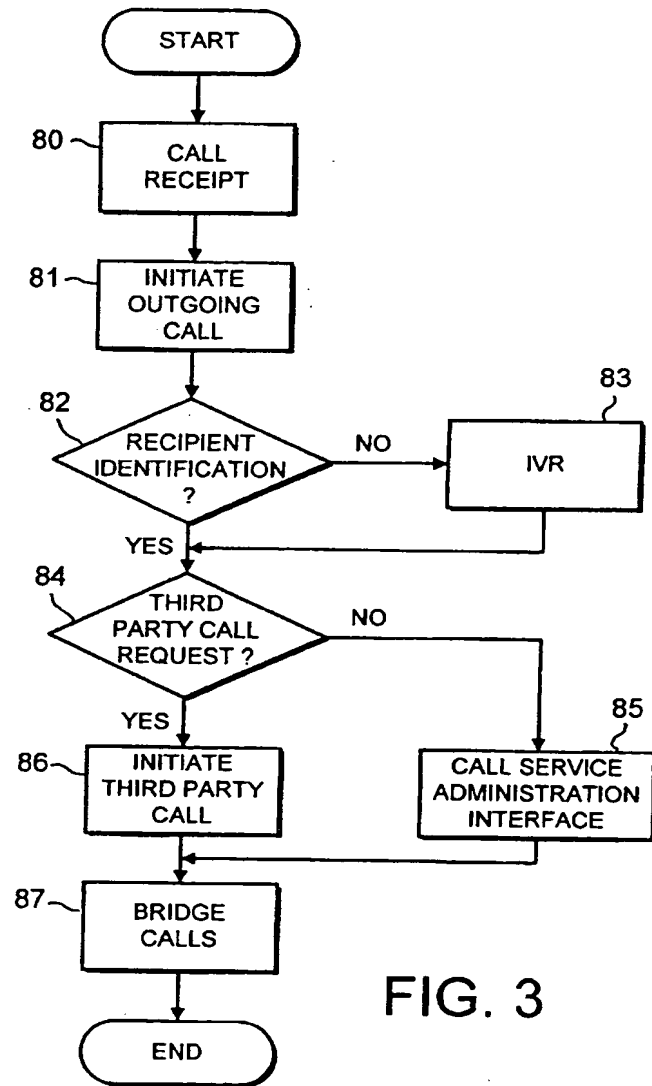


FIG. 3

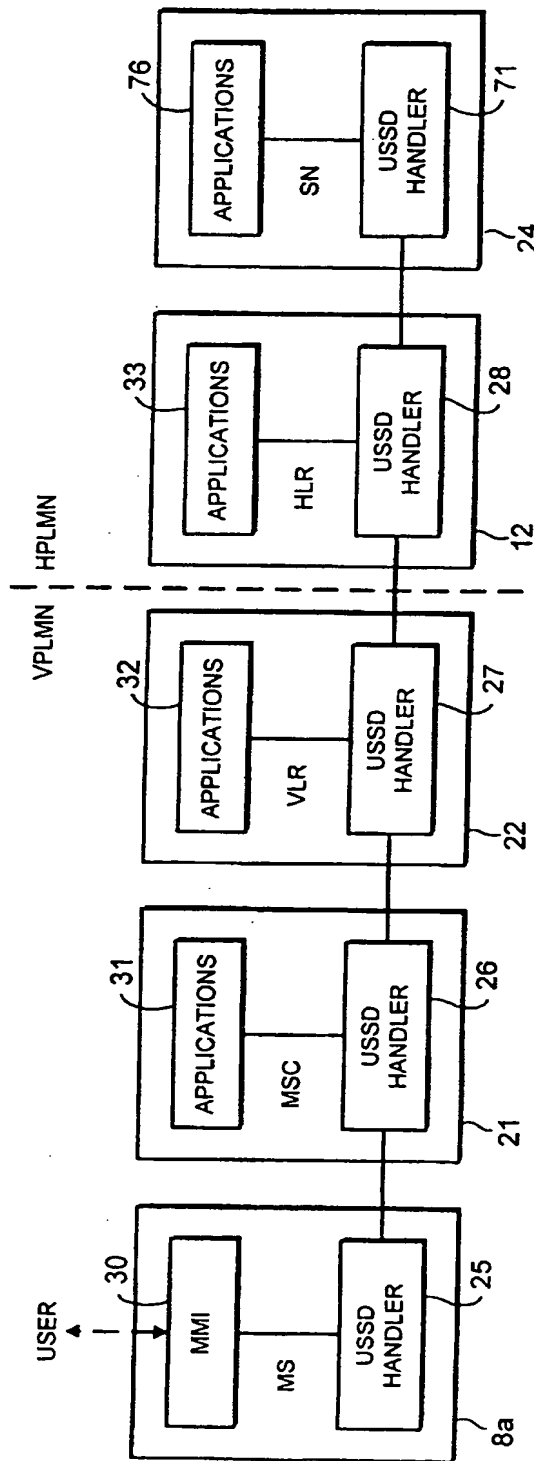


FIG. 4

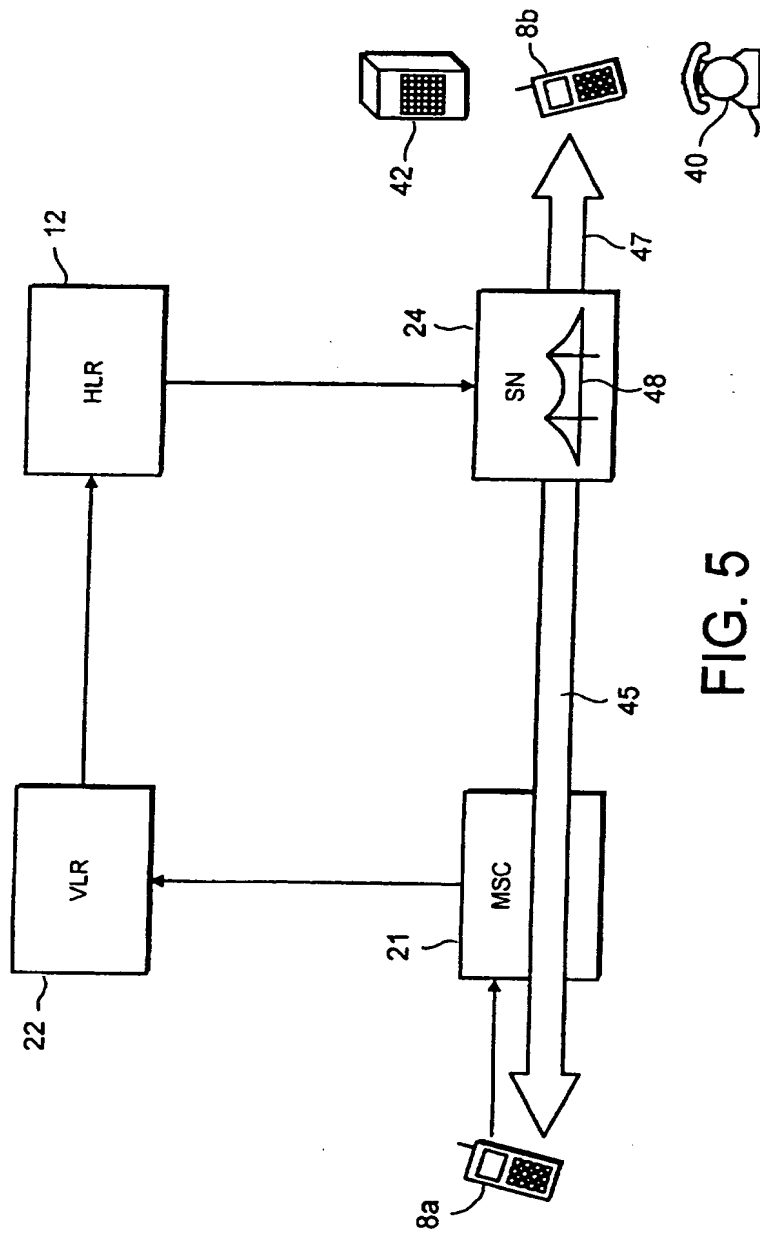


FIG. 5

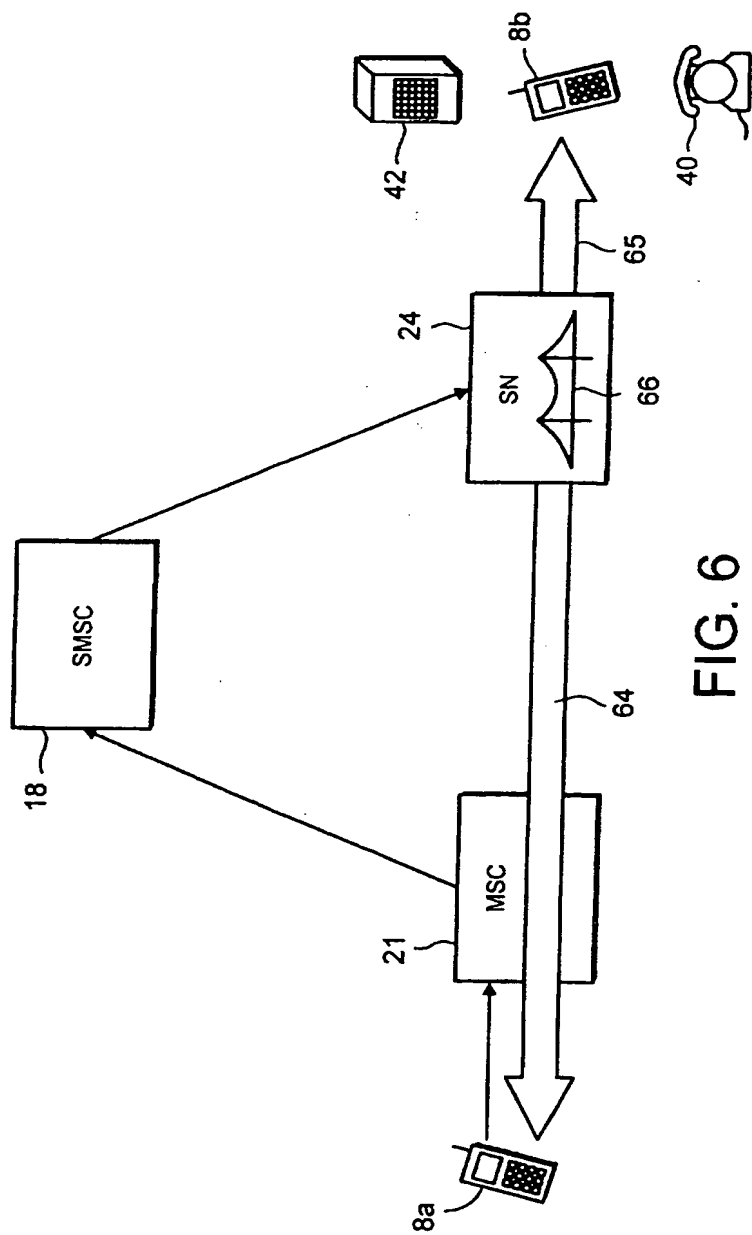


FIG. 6

MOBILE COMMUNICATIONS**Background of the Invention**

This invention relates to mobile communications, and more specifically but not exclusively to apparatus for and methods of establishing
5 circuit connections in a mobile communications system such as a GSM (Global System for Mobile Communications) digital cellular radio network.

If a subscriber is outside his home network and is roaming in a visited (foreign) network, any call initiated by the subscriber from his mobile station is established from the visited network. International call rates charged by a
10 visited network for a call made to a party in the home network can be considerably higher than that charged by the home network for a call to the roaming subscriber established from the home network. It would be desirable to provide apparatus and methods enabling, *inter alia*, cheaper call rates for roaming subscribers.

15 In the field of telecommunications, callback methods for setting up calls in a reverse direction are known, for example from US-A-5438616 and US-A-5710809.

US-A-5438616 describes a fixed line telephone system comprising a first and a second party interconnected via a controller. Initially, a first
20 connection is established between the first party and the controller by the first party placing a telephone call to a telephone number associated with the controller. Once this connection is established, the controller receives and

stores a first callback telephone number and a second callback telephone number as provided by the first party. Then the first connection is torn down by initiating conventional hang-up procedures. A second connection is re-established between the first party and the controller by operation of the
5 controller to initiate a telephone call to the first callback telephone number. Then, a third connection is established between the second party and the controller by operation of the controller to initiate a telephone call to the second callback telephone number. Finally, the first party and the second party are bridged to allow conversation by coupling the second connection to
10 the third connection.

US-A-5710809 describes a fixed line telecommunications system comprising a telecommunications node local to a calling location, a central switching unit associated with a called location, a conventional voice network and a data signalling channel external to the voice network linking the
15 telecommunications node with the switching unit. A call from the calling location is received by the telecommunications node which transmits caller and called party identifications via the data signalling channel to the switching unit. The switching unit interrogates the called location by initiating a first call to the called location and, on answer from the called location, initiates a
20 second phone call to the calling location via the voice network and the telecommunications node. Thereupon, the first and second calls are teleconferenced.

These, and other known callback methods, require the calling party to initiate a callback using a call to a network node, whether it is local or distant, which alone or in cooperation with other network nodes arranges the callback. ✓

Summary of the Invention

5 According to one aspect of the present invention, there is provided apparatus for use in a mobile communications network, the apparatus comprising: means for receiving a callback request signal originated from a mobile station using a non-circuit-related data transfer mechanism, and calling means for establishing a first circuit connection with the mobile station in
10 response to the callback request signal.

 According to another aspect of the present invention, there is provided a method of establishing a circuit connection between an apparatus in a mobile communications network and a mobile station, the method comprising: receiving a callback request signal originated from the mobile
15 station using a non-circuit-related data transfer mechanism; and arranging a circuit connection from the apparatus to the mobile station in response to receipt of the callback request signal.

 The use of a non-circuit-related data transfer mechanism has various advantages not available with the prior art methods, in which a voice call must
20 be placed in order to initiate a callback request. ✓

 The procedure for setting up a call may be more convenient and familiar to the user than that using a voice call for the callback request, since

the user may compose the message using only keyboard and graphical display interactions, similar to the more familiar forward direction call set up procedure, instead of participating in a preliminary call. The request may for example be generated by interaction with a menu facility on a display of the mobile station.

Furthermore, as the cost to the user, in particular when being served in a visited network, of the transmission from the mobile station of signals using a non-circuit-related data transfer mechanism is generally less than the cost of a circuit-based voice or data call for the same purpose, the invention provides means and methods for call establishment which are not only convenient but also more cost-effective to the user of the mobile station than prior art methods.

According to another aspect of the invention, there is provided a mobile station comprising: means for recognising a predetermined command entered by a user as a callback request command and for generating a callback request in response thereto; means for transmitting the generated callback request using a non-circuit-related data transfer mechanism; and means for receiving a circuit connection establishment request signal following transmission of the callback request.

This aspect of the invention is intended to provide further convenience to the user in using the callback service of the present invention, insofar as the mobile station is adapted to format information provided by the user as a

recognisable callback request when transmitted, without the need for the user to memorise or utilise the required message format.

Brief Description of the Drawings

Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a block diagram of a mobile communications network arranged in accordance with first and second embodiments of the invention;

Figure 2 illustrates a service node arranged in accordance with the first and second embodiments of the invention;

Figure 3 is a flow diagram illustrating steps carried out by the service node of Figure 2;

Figure 4 is a block diagram illustrating how USSD messages are handled in a first embodiment of the invention;

Figure 5 is a block diagram illustrating the operation of the first embodiment of the invention; and

Figure 6 is a block diagram illustrating the operation of the network in accordance with the second embodiment of the invention.

Detailed Description of the Drawings

Referring first to Figure 1, a Mobile Switching Centre (MSC) 2 is connected via communication links to a number of Base Station Controllers (BSCs) 4. The BSCs 4 are dispersed geographically across areas served by the Mobile Switching Centre 2. Each BSC 4 controls one or more Base

Transceiver Stations (BTSs) 6 located remote from, and connected by further communication links to, the BSC 4. Each BTS 6 transmits radio signals to, and receives signals from, mobile stations 8 which are in an area served by that BTS 6. The area is referred to as a "cell". A GSM network is provided
5 with a large number of such cells, which are ideally contiguous to provide continuous coverage over the whole network territory.

A Mobile Switching Centre 2 is also connected via communication links to other mobile switching centres in the remainder of the mobile communications system 10, which includes other GSM networks, in particular
10 GSM networks (having configurations similar to that illustrated) in other territories having roaming agreements with the illustrated network, and to a Public Service Telephone Network (PSTN), which is not illustrated. The Mobile Switching Centre 2 is provided with a Home Location Register (HLR)
12 which is a database storing subscriber data including the International
15 Mobile Subscriber Identity (IMSI) which is unique to each mobile station 8. ✓
The IMSI is also stored in the mobile station in a removable data store, referred to as a Subscriber Identity Module (SIM), along with other subscriber-specific information.

The Mobile Switching Centre 2 is also provided with a Visitor
20 Location Register (VLR) 14 which is a database temporarily storing subscriber data for mobile stations which are active in the area served by the Mobile Switching Centre 2.

The network additionally comprises a Service Node 24 which is connected, in a manner to be detailed below, to the MSC 2, the HLR 12 and a Short Message Service Centre (SMSC 18).

5 The storing and forwarding of SMS messages in the network is managed by a Short Message Service Centre (SMSC) 18. The SMSC 18 connected to MSC 2 is used in the second embodiment of the invention, and is directly or indirectly connected to the service node 24. The transmission of SMS messages from the MSC 2 to the service node 24 is relayed by the SMSC 18.

10 Figure 2 shows a schematic block diagram of the service node 24, incorporating the first and second embodiments of the invention. The service node 24 comprises a USSD Handler 71 and a Short Message Handler 72 for receiving USSD and SMS messages, respectively. The service node 24 also comprises a switch matrix 73. The switch matrix 73 terminates a large
15 number of voice circuits 74 and is capable of accepting incoming voice calls, generating outgoing voice calls and cross-connecting different circuits. It is also capable of connecting voice calls to an Interactive Voice Response Unit (IVRU) 75. The IVRU 75, in turn, is capable of accepting DTMF signalling and playing recorded announcements, to conduct interactions with service
20 users.

The USSD Handler 71, the Short Message Handler 72, the switch matrix 73 and the IVRU 75 each are connected to a Service Node Control

Processor (SNCP) 76. The SNCP 76 is responsible for the processing service logic for supported services, the control of signalling and other interfaces, and the control of the Switch Matrix 73. The SNCP 76 illustrated is interfaced with a database 77 which contains on-board subscriber and service data.

5 Alternatively, the SNCP 76 may also use the services of an external Service Data Function.

In addition, the service node 24 also includes external interfaces 78, 79 for SS7 signalling, and Administration, Maintenance and Provisioning (OAM&P), respectively.

10 The operation of the service node 24 is now described in connection with the flow diagram of Figure 3.

At step 80, a callback request is received by either USSD Handler 71 or Short Message Handler 72. A callback request received by either of these interfaces is passed to the appropriate application in the SNCP 76. ✓

15 At step 81, the SNCP 76 initiates a first outgoing call to the requesting subscriber using an available port of the Switch Matrix 73.

At step 82, the SNCP 76 determines whether an identifiable recipient exists. If no such recipient identification has been received then the SNCP 76, at step 83, determines the required service through use of the IVRU 75. This is achieved by connecting the voice circuit supporting a successful outgoing
20 call to the subscriber to a port of the IVRU 75, instructing the IVRU 75 to

play appropriate announcements, and gathering and interpreting the subscriber's responses, which may be voiced and/or DTMF tones.

At step 84, the SNCP 76 determines whether the received service request is a third party call request or a request for a network service provided in the home network. In the latter case, the SNCP initiates a second outgoing call to the required service administration interface at step 85. If the service request is a third party call request, the SNCP 76 initiates a second outgoing call to the required third party number at step 86, using an available port of the switch matrix 73. On successful establishment of the second outgoing call the SNCP 76 instructs the switch matrix 73 at step 87 to bridge the two associated call legs together, allowing two way communication between the subscriber and their chosen service or third party.

In the first embodiment of the invention, the GSM Unstructured Supplementary Service Data (USSD) data transfer mechanism is used. The USSD data transfer mechanism is defined in, *inter alia*, the GSM Technical Specifications 02.90, 03.90 and 04.90 (published by the European Telecommunications Standards Institute). The USSD data transfer mechanism allows mobile subscribers to transmit user specified data to a network entity on the basis of unstructured message protocols. For example, a mobile station can transmit text messages generated by the user via the station's man-machine interface (MMI) to a network entity to be processed by an associated application.

The USSD signalling between the network and the mobile station is performed in a transparent way, i.e. no review or manipulation of the user-specified contents of the USSD request is performed during transmission other than in the HLR application module. Using the USSD data transfer
5 mechanism, a mobile station can communicate with a network entity without establishing a circuit connection and without requiring a dedicated two-way transmission channel. Rather, the signalling is performed through a non-circuit-related data transfer mechanism between the mobile station and the network, using a Stand-alone Dedicated Control Channel (SDCCH) in the
10 radio interface.

According to the first embodiment of the invention, a subscriber who uses his mobile station in a roamed-to network, referred to in GSM as a Visited Public Land Mobile Network (VPLMN), can transmit a specially formatted USSD message from his mobile station to the subscriber's home
15 network, referred to in GSM as the Home Public Land Mobile Network (HPLMN). This has the effect of initiating a first call from the HPLMN to the subscriber's mobile station, a second call from the HPLMN to a recipient party the subscriber wishes to call, and the first and second calls to be bridged.

Figure 4 illustrates how a USSD message originated by a mobile
20 station 8a roaming in a VPLM is handled in accordance with this embodiment. The message is first passed to the serving MSC 21 in the VPLMN, on to the VLR 22 associated with that MSC, and via inter-network

links, to the subscriber's home HLR 12. The HLR passes the message to the callback service node 24 in the HPLMN. Each of the illustrated entities, i.e. mobile station 8a, MSC 21, VLR 22, HLR 12, and service node 24 comprises a USSD handler 25 to 29, respectively. Mobile station 8a comprises a Man-
5 Machine Interface (MMI) 30 which allows the user to enter a USSD message into MS 8a. MMI 30 in turn is linked with the station's USSD handler 25.

Each of MSC 21, VLR 22 and HLR 12 comprises an application module 31 to 33, respectively. The application modules 31 to 33 in turn are linked with USSD handlers 26, 27 and 28, respectively. The USSD handlers
10 examine a received USSD message to determine whether the message should be processed locally, or passed on to the next USSD handler in the chain, as defined in GSM Technical Specification 03.90, section 6. The application modules 31 to 33 are provided for processing a USSD message locally in the respective network entity. The location, nature and content of the USSD
15 application modules is determined by the service provider and/or network operator.

The operation of the first embodiment is now described in connection with Figure 5.

If the subscriber using mobile station 8a wishes to initiate a call in
20 accordance with the first embodiment, he first activates his mobile station 8a, and enters an alphanumeric character string, having a predetermined callback request format, by using the keys of mobile station 8a and instructs the

transmission thereof to the serving network. Alternatively, the mobile station may be adapted such that a correctly formatted USSD message can be created and sent by means of a dedicated callback menu facility on the mobile station.

For example, the SIM of the mobile station 8a may be provided with a
5 prestored application program (e.g. a SIM Application Toolkit program, see
GSM Technical Specification 11.14) which is arranged to instruct the mobile
station to provide one or more selectable menu options (e.g. "Voicemail
Callback", "Third Party Callback", etc.), to allow user interaction in a selected
menu option and to create and instruct the mobile station 8a to transmit a
10 USSD message which is correctly formatted in the predetermined callback
request format. The user would thus select from menu options which are
represented graphically on the display of the mobile station (e.g. "Third Party
Callback"). The user may then be prompted to select from further menu
options a desired prestored third party telephone number, or to enter the third
15 party telephone number by using the keyboard of mobile station 8a. The
mobile station would then convert the entered information into the
predetermined callback request format before transmission as a USSD
message.

The USSD message also contains the actual user data, e.g. the
20 alphanumeric character string input by the user. The user data includes a
predetermined character set and is arranged in a defined callback message
format (for example including a predetermined character set in a

predetermined part of the message) indicating that the message is to be passed to the service node 24. It also includes the Mobile Station International Directory Number (MSISDN, often referred to simply as the "directory number"). The MSISDN is included because the MSISDN is required to
 5 enable the home network to establish a return call to the calling subscriber in the visited network. Alternatively, the MSISDN may be omitted *since an* appropriate MSISDN may be retrieved, with reference to the IMSI of the subscriber (which is generally included in the USSD signalling) of the subscriber, from the home HLR 12 by or on behalf of the service node 24.

10 The user data may include data identifying the required service. This may identify a network service to be administered, in which case a service code unique to the service is included, or the establishment of a call to a third party, in which case the number of the third party to be called is included.

Once the subscriber has entered the required information and the
 15 USSD message has been transmitted from the mobile station 8a, the USSD message is transmitted via the radio interface and network elements of the visited network to the serving MSC 21. The MSC 21 then sets up a transaction to its associated VLR 22 and forwards the USSD request to the VLR 22 unchanged.

20 When the VLR 22 receives the USSD request, the VLR 22 checks, using the IMSI supplied in the USSD request whether the user is not in the HPLMN, as is the case for the scenario being considered. The VLR 22 then

Home land mobile network

sets up a transaction to the subscriber's home HLR 12 in the HPLMN and forwards the USSD request to the HLR 12 unchanged.

The message handler 28 in the HLR 12 passes the request to the service node 24. Finally, the service node 24 interprets the USSD request and
5 initiates a call to the calling subscriber (as indicated by arrow 45). Depending on the content of the request, the service node 24 may also initiate a call to a recipient requested to be called (as indicated by arrow 47), and bridge the first and second calls (as indicated at 48). The recipient may be another mobile station 8b, a fixed line terminal 40 or a further service node 42 of the
10 HPLMN, such as a voice mail retrieval system. Otherwise, the call may be handled in the service node 24.

The above transmission steps between the entities of the networks are transparent, i.e. the USSD messages are forwarded from one entity to another unchanged. No dedicated traffic channel (TCH) needs to be used. In other
15 words, USSD messages do not require the end-to-end establishment of a traffic path. Also, USSD message transmission may take place even if the mobile station is already in full circuit communication. This aspect may be used to transmit a connection request to the service node 24 to conference in further parties to a call.

20 In the second embodiment of the invention, the Short Message Service (SMS) data transfer mechanism is employed. The SMS data transfer

mechanism is a data transfer teleservice defined in, *inter alia*, GSM Technical Specification 03.40.

The operation of the participating entities in accordance with the second embodiment is illustrated in connection with Figure 6. Figure 6 illustrates a mobile station 8a, a VPLMN MSC 21, the HPLMN SMSC 18, and the service node 24 in the mobile station's HPLMN. Similar to the operation in accordance with the first embodiment, if the subscriber using mobile station 8a wants to transmit a callback request, he activates his mobile station 8a, enters an SMS message, having a predetermined callback request format, by using the keys of mobile station 8a and transmits it to the unique destination address of the service node 24 in his home network. Alternatively, the mobile station may be adapted such that a correctly formatted SMS message can be created and sent by means of a dedicated callback menu facility on the mobile station. For example, the SIM of the mobile station 8a may be provided with a stored application program (e.g. a SIM Application Toolkit program) which is arranged to instruct the mobile station to provide one or more selectable menu options (e.g. "Voicemail Callback", "Third Party Callback", etc.), to allow user interaction in a selected menu option and to create and instruct the mobile station 8a to transmit an SMS message which is in the predetermined callback request format. The user would thus select from the menu options on the display of mobile station 8a, as described in connection with the first embodiment. The mobile station 8a then converts

the entered information into the predetermined callback request format, using the address of the service node 24 as the destination address of the message, before transmission.

The SMS message contains the subscriber's MSISDN number, to be used for the callback, as the originating address. The contained MSISDN is the subscriber's primary voice MSISDN; alternate line service MSISDNs are not supported in the current protocol. IF an alternate line service MSISDN is preferred to be used for the callback, it may be specified in the user data content. If no MSISDN is included in the user data, the subscriber's primary MSISDN is used as a default number for the callback.

The user data may include data identifying the required service. This may identify a network service to be administered, in which case a service code unique to the service is included, or the establishment of a call to a third party, in which case the number of the third party to be called is included.

Once the subscriber has entered the required information the SMS message is transmitted from the mobile station 8a via the radio interface and network elements of the visited network to the serving MSC 21. The MSC 21 forwards the short message to the home network SMSC 18, which in turn forwards it to the short message handler of the service node 24. Finally, the service node 24 parses the callback request, initiates a first outgoing call to the subscriber's mobile station 8a as indicated by arrow 64, and if appropriate initiates a second outgoing call to a recipient party to be called as indicated by

arrow 65, and bridges the first and second outgoing calls as indicated at 66. The recipient may be another mobile station 8b, a fixed line terminal 40 or a further service node 42 of the HPLMN, such as a voice mail retrieval system. Otherwise, the call may be handled in the service node 24.

5 SMS messages do not require the end-to-end establishment of a traffic path. Also, short message transmission may take place even if the mobile station is already in full circuit communication. This aspect allows a user to transmit a connection request to the service node 24 to teleconference in further parties to a call.

10 It should be noted that the present invention is not limited to the embodiments as described above.

For example, the service node 24 need not be configured to handle callback requests in the form of both USSD and SMS message, but may handle only one type of non-circuit-related data transfer mechanism.

15 The invention is not limited to the non-circuit-related data transfer mechanisms exemplified (i.e. USSD and SMS). Indeed, the invention is not limited to the GSM standard but may be used in other systems in which subscribers may roam from one network to another.

20 It is envisaged that various other modifications and variations to the above described embodiments could be made without falling outside the scope of the invention as determined from the claims.

CLAIMS:

1. Apparatus for use in a mobile communications network, the apparatus comprising means for receiving a callback request signal originated
5 from a mobile station using a non-circuit-related data transfer mechanism, and calling means for establishing a first circuit connection with the mobile station in response to the callback request signal.
2. The apparatus of claim 1, wherein the callback request signal
10 comprises an alphanumeric message.
3. The apparatus of claim 1 or 2, wherein when the apparatus is arranged in a first mobile communications network it is capable of receiving said callback request signal while the mobile station is receiving service in a
15 second mobile communications network.
4. The apparatus of claim 3, wherein the first network is the home network of the mobile station, and the second network is a visited network in which the mobile station has roaming status.

5. The apparatus of any preceding claim, wherein the calling means is arranged to establish a second circuit connection with a recipient, and to bridge the first and second circuit connections.

5 6. The apparatus of claim 5, wherein the callback request signal comprises a telephone number of a third party.

7. The apparatus of any preceding claim, wherein the callback request signal comprises data identifying a network service to which a circuit
10 connection is to be provided by the apparatus, such as an answerphone service.

8. The apparatus of any preceding claim, wherein the callback request signal is transmitted from the mobile station via a Stand-alone
15 Dedicated Control Channel (SDCCH).

9. The apparatus of any preceding claim, wherein the callback request signal comprises a data transfer teleservice signal.

20 10. The apparatus of claim 9, wherein the callback request signal comprises a Short Message Service (SMS) message.

11. The apparatus of any of claims 1 to 8, wherein the callback request signal comprises an Unstructured Supplementary Service Data (USSD) message.

5 12. The apparatus of any preceding claim, wherein the callback request signal comprises data identifying the mobile station.

13. A method of arranging a circuit connection using a mobile station receiving service in a first mobile communications network, the
10 method comprising:

generating a callback request in said mobile station in response to user input;

transmitting said callback request from said mobile station using a non-circuit-related data transfer mechanism, such that said request is
15 forwarded by said first network to a second network; and

subsequently receiving at said mobile station a circuit connection establishment request, originated in said second network, from said first network.

20 14. A method of establishing, in a first mobile communications network, a circuit connection with a mobile station receiving service in a second mobile communications network,

said method including receiving in said first network a callback request signal, originated from said mobile station using a non-circuit-related data transfer mechanism, from said second network; and

transmitting from said first network a circuit establishment request to
5 said mobile station via said second network.

15. A method of establishing a circuit connection between an apparatus in a mobile communications network and a mobile station, the method comprising:

10 receiving a callback request signal originated from the mobile station using a non-circuit-related data transfer mechanism; and

arranging a circuit connection from the apparatus to the mobile station in response to receipt of the callback request signal.

15 16. A mobile station comprising:

means for recognising a predetermined command entered by a user as a callback request command and for generating a callback request in response thereto;

20 means for transmitting the generated callback request using a non-circuit-related data transfer mechanism; and

means for receiving a circuit connection establishment request signal following transmission of the callback request.

17. The mobile station of claim 16, wherein said recognising and generating means comprises a dedicated callback menu facility.

5 18. Apparatus, or a method, substantially as hereinbefore described, in particular with reference to Figures 1 to 6.



Patent
Office

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INVESTOR IN PEOPLE

Application No: GB 9822108.8
Claims searched: 1 to 18

Examiner: Glyn Hughes
Date of search: 9 February 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.Q): H4L (LDPP, LECX), H4K (KF42)

Int CI (Ed.6): H04Q 7/22, 7/32, H04M 3/42, 3/48

Other: Online: WPI, PAJ, EPODOC

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	WO 98/09463 A2 (QUALCOMM) see whole document	-
A	WO 96/20572 A1 (ERICSSON) see whole document	-

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.